REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-19 and 39 are active in the present application. Claims 1 and 19 are amended, and Claim 39 is added by the present amendment. Claims 20-38 are indicated as withdrawn in response to a previous restriction requirement.

Amendments to the claims and the new claim find support in the specification as originally filed at least at page 22, lines 17-23, and page 26, lines 6-11. Thus, no new matter is added.

In the outstanding Office Action, Claims 1-19 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1-14 and 19 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,710,620 to Taniguchi; and Claims 15-18 were rejected under 35 U.S.C. § 103(a) as unpatentable over Taniguchi and Applicants' Admitted Art (herein "AAA").

Initially, Applicants and Applicants' representative gratefully acknowledge the courtesy of a personal interview with Examiner Song on January 4, 2007. During the interview, the inventions described in the specification were discussed, and differences between the claimed inventions and the references in the outstanding Office Action were discussed. Further, claim amendments were discussed to more clearly recite the intended features. Comments and claim amendments discussed during the interview are reiterated below.

Regarding the rejection under 35 U.S.C. § 112, second paragraph, Claims 1 and 19 are amended to more clearly recite the intended features. Further, as discussed during the interview, the amendments to Claims 1 and 19 appear to overcome the rejections under 35 U.S.C. § 112, second paragraph. In particular, Applicants respectfully note that contrary to

the assertions in the Office Action,[1] the point spread distribution is not variable with a process of the apparatus but instead is determined by structural parameters of the apparatus. In particular, as noted in the specification at equation 3, the point spread distribution is determined by a wavelength of the light and a numerical aperture NA of an image side of the image forming optical system. Accordingly, it is believed that the claims clearly recite the intended features of the inventions. Therefore, it is respectfully requested the rejection under 35 U.S.C. § 112, second paragraph, be withdrawn.

Further, Applicants respectfully traverse the rejection of Claims 1-14 and 19 under 35 U.S.C. § 102(b) as anticipated by Taniguchi, with respect to amended independent Claims 1 and 19.

Claim 1 is directed to a crystallization apparatus that includes, in part, a phase modulation element in which a phase of outgoing light beams relative to incident light beams differs depending on each position, and the phase modulation element includes at least two phase modulation units and is configured to transmit a light having a phase distribution based on a phase pattern of the at least two phase modulation units to vary a light intensity distribution at the non-single crystal semiconductor film. Each of the at least two phase modulation units are optically smaller than a radius of a point spread distribution range of the image formation optical system when converted to an image formation surface of the image formation optical system. Independent Claims 19 and 39 include similar features.

In a non-limiting embodiment, Applicants' Figures 3A-3F and 4A-4C show a crystallization apparatus that includes a phase modulation element 1 having at least two phase modulation units. For example, the embodiment of phase modulation element 1 shown in Applicants' Figure 3C includes 25 phase modulation units (i.e., grid-like square patterns on the phase modulation element 1), and the embodiment of phase modulation element 1 shown

[1] Page 3, lines 3-7.

in Figures 4A-4C includes 4 phase modulation units (i.e., the sections of phase modulation unit 1 that may be differently shaded). Further, the arrangement of light phases that each of the phase modulation units is configured to transmit (i.e., the phase pattern of the at least two phase modulation units) creates a particular phase distribution and a corresponding point spread function (e.g., point spread function of Fig. 5B) that is configured to vary a light intensity distribution on the non-single crystal semiconductor film at the image plane 3f.

Applicants' Figures 4A-4C show typical relationships between changes in phase in the point spread distribution range R and the light intensity. Figure 4A shows a phase pattern in which phase values in four areas are all zero degree. A sum of four phase vectors 4g each having an amplitude E in a direction of zero degrees yields an amplitude of 4E, and a square of the amplitude corresponds to a light intensity 16I.

On the other hand, Applicants' Figure 4B shows a phase pattern of phase modulation units in which two areas transmit light at zero degrees and the other two areas transmit light at 90 degrees. In this case, a sum of the two phase vectors in the direction of zero degrees and the two phase vectors in the direction of 90 degrees corresponds to an amplitude of $2\sqrt{2}E$, and a square of the amplitude corresponds to a light intensity 8I.

Therefore, in the present invention, the light intensity on the imaging surface may be varied by the at least two phase modulation units that are optically smaller than a radius of the point spread distribution range R of the image formation optical system.

As discussed during the interview, Taniguchi fails to teach or suggest each of the features of the independent claims. In particular, Taniguchi fails to teach or suggest a crystallization apparatus that includes a phase modulation element having at least two phase modulation units and configured to transmit a light having a phase distribution based on a phase pattern of the at least two phase modulation units to vary a light intensity distribution at the non-single crystal semiconductor film. Further, Taniguchi fails to teach or suggest that

each of the at least two phase modulation units are optically smaller than a radius of a point spread distribution range of the image formation optical system.

Taniguchi describes a projection exposure method and apparatus for irradiating an illumination light onto a mask (e.g., a phase modulation element) having a plurality of patterns and a projection optical system (e.g., image formation optical system) for projecting images of the patterns onto a photosensitive substrate (e.g., non-single crystal semiconductor film).[2] However, Taniguchi fails to teach or suggest any size relationship between the patterns on the mask and a radius of a point spread distribution range of the projection optical system. In addition, Taniguchi fails to teach or suggest any relationship between a size of a pattern on the mask and a numerical aperture of the projection optical system. Moreover, Taniguchi appears to be silent regarding any point spread distribution range or numerical aperture of the projection optical system.

Thus, it is respectfully submitted that Taniguchi fails to teach or suggest the claimed size relationships and further Applicants respectfully submit that the apparatus of Taniguchi would not inherently have the capabilities of the claimed image formation optical system, because there is no suggestion or mention in Taniguchi of those size relationships or of those corresponding parameters. Accordingly, Applicants respectfully submit that Taniguchi fails to teach or suggest that "phase modulation units are optically smaller than a radius of a point spread distribution range of the image formation optical system," as recited in independent Claims 1, 19, and 39.

Further, Taniguchi indicates that when there are plural patterns on the mask which are being transferred to a photosensitive substrate in a single exposure, phase shifters may be added to compensate for imaging characteristics of the projection optical system.[3] Thus,

[2] Taniguchi at Abstract and Figure 1.
[3] Taniguchi at column 4, lines 1-12.

Taniguchi indicates that phase shifting is done for purposes of improving and correcting deficiencies in a portion of the optical system. However, Taniguchi is silent regarding varying a light intensity distribution at an illuminated surface or at a non-single crystal semiconductor film. In other words, Taniguchi indicates that the phase shifters allow the projection of all patterns from a mask under satisfactory imaging characteristics even though there may be several different patterns on the mask,[4] and Taniguchi is silent regarding any phase pattern that varies a light intensity distribution at the output. Accordingly, Applicants respectfully submit that Taniguchi also fails to teach or suggest a phase modulation element configured to "transmit a light having a phase distribution based on a phase pattern of the at least two phase modulation units to vary a light intensity distribution at the non-single crystal semiconductor film," as recited in independent Claims 1, 19 and 39.

Accordingly, Applicants respectfully submit that independent Claims 1, 19, and 39, and claims depending therefrom, patentably define over Taniguchi.

In addition, Applicants respectfully traverse the rejection of Claims 15-18 under 35 U.S.C. § 103(a) as unpatentable over Taniguchi in view of AAA.

Claims 15-18 depend from Claim 1, which appears to patentably define over Taniguchi as discussed above. Further, Applicants respectfully submit that AAA fails to teach or suggest the claimed features lacking in the disclosure of Taniguchi. Accordingly, it is respectfully requested the rejection of Claims 15-18 under 35 U.S.C. § 103(a) be withdrawn.

New Claim 39 and is directed to an embodiment of the invention in which the phase modulation element is configured to transmit the outgoing light beams in at least one direction. Applicants respectfully submit that Taniguchi also fails to teach or suggest that features.

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[4] Taniguchi at column 3, lines 43-47.

Accordingly, Applicants respectfully submit that independent Claims 1, 19, and 39, and claims depending therefrom, are allowable.

Consequently, in light of the above discussion and the present amendment, this application is believed to be in condition for allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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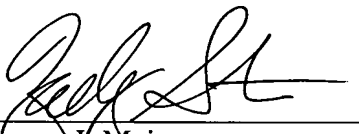

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